



This document contains proprietary information and neither the document nor the said proprietary information shall be published, reproduced, copied, or disclosed without the express written permission of a duly authorized representative of the company.

# Cable

## Procurement/Performance

## Specification

## DOCUMENT IDENTIFIER

Code: PROC\_2K10502\_D01

File Code: PROC\_2K10502\_D01, Cable.doc

## REVISIONS

Status	Description	Date	Approvals
A	Issue	February 05, 2001	
B	Revision, changed paragraphs 2.1.1, 2.1.2, 2.1.5, 3.2.1, 3.3.1.1, 5.1	April 10, 2001	
C	Revision, previous Rev.B is here included in Section 1, added Section 2, changed Table of Contents, changed List of Figures.	July 10, 2002	
D	Revision, changed para. 1 of Section 2, added Section 3 and Figure 4, changed Table of Contents, changed List of Figures.	August 29, 2002	

## DISTRIBUTION LIST

On every change of the revision status, copies of this document are automatically distributed to their recipients as listed below.

Copy 001 Int G & A Engineering, distribuzione ISO 9001

Copy 001 Ext Agenzia Spaziale Italiana

Copy 002 Ext Responsabile di Programma, Agenzia Spaziale Italiana

Copy 003 Ext Responsabile Tecnico Scientifico per Agenzia Spaziale Italiana

Copy 004 Ext Manufacturer

## ADMINISTRATIVE INFORMATION

Customer: Agenzia Spaziale Italiana – 00161 Roma, Viale Liegi 26

Contract: No. I/006/01/0, date 30 Gennaio 2001

## APPROVALS

---

Ing. Antonio Pontetti  
G & A Engineering s.r.l.  
Responsabile di Programma

---

Prof. Roberto Battiston  
Responsabile Tecnico Scientifico  
per L'Agenzia Spaziale Italiana

---

Dr. Carlo Bonifazi  
Responsabile di Programma  
Agenzia Spaziale Italiana

## TABLE OF CONTENTS

<b><u>Section 1</u></b>	<b><u>Title</u></b>	<b><u>Page</u></b>
1.	SCOPE	5
2.	APPLICABLE DOCUMENTS	5
2.1	Governmental	5
2.1.1	Specifications	5
2.1.2	Standards	5
2.1.3	Drawings	5
2.1.4	Procedures	5
2.1.5	Publications	5
2.1.6	Other Documents	5
2.2	Non Governmental	5
2.2.1	Specifications	5
2.2.2	Standards	5
2.2.3	Drawings	5
2.2.4	Procedures	5
2.2.5	Publications	6
2.2.6	Other Documents	6
3.	REQUIREMENTS	7
3.1	Definition	7
3.2	Characteristics	7
3.2.1	Performance Characteristics	7
3.2.2	Physical Characteristics	7
3.2.3	Reliability	7
3.2.4	Maintainability	7
3.2.5	Environmental Conditions	7
3.2.6	Transportability	8
3.3	Design and Construction	8
3.3.1	Materials, Parts and Processes	8
3.3.1.1	Toxic Products	8
3.3.1.2	Parts	8
3.3.2	Electromagnetic Interference	8
3.3.3	Nameplates and Product Marking	8
3.3.4	Workmanship	8
3.3.5	Interchangeability	8
3.3.6	Safety	8
3.3.7	Human Engineering	9
3.3.8	Security	9
3.3.9	Property Issues	9
3.4	Documentation	9
3.5	Logistics	9
3.6	Personnel and Training	9
3.7	Major Component Characteristics	9
3.8	Precedence	9
3.9	Qualification	9
3.10	Samples	9
4.	QUALITY ASSURANCE PROVISIONS	10
4.1	Responsibility for Inspection	10
4.2	Special Tests and Inspections	10
4.3	Quality Conformance Inspections	10
5.	PREPARATION FOR DELIVERY	10

5.1	Preservation and Packaging	10
5.2	Packing	11
5.3	Marking for Shipment	11
6.	NOTES	11
6.1	Intended Use	11
6.2	Ordering Data	11
6.3	Use of Documents	11
6.4	Destination of Goods	11
6.5	Further Procurements	11
7.	APPENDIX	11

<b><u>Section 2</u></b>	<b><u>Title</u></b>	<b><u>Page</u></b>
1.	SCOPE	14
2.	APPLICABLE DOCUMENTS	14
2.1	Governmental	14
2.1.1	Specifications	14
2.1.2	Standards	14
2.1.3	Drawings	14
2.1.4	Procedures	14
2.1.5	Publications	14
2.1.6	Other Documents	14
2.2	Non Governmental	15
2.2.1	Specifications	15
2.2.2	Standards	15
2.2.3	Drawings	15
2.2.4	Procedures	15
2.2.5	Publications	15
2.2.6	Other Documents	15
3.	REQUIREMENTS	16
3.1	Definition	16
3.2	Characteristics	16
3.2.1	Performance Characteristics	16
3.2.2	Physical Characteristics	16
3.2.3	Reliability	17
3.2.4	Maintainability	17
3.2.5	Environmental Conditions	17
3.2.6	Transportability	17
3.3	Design and Construction	17
3.3.1	Materials, Parts and Processes	17
3.3.1.1	Toxic Products	18
3.3.1.2	Parts	18
3.3.2	Electromagnetic Interference	18
3.3.3	Nameplates and Product Marking	18
3.3.4	Workmanship	18
3.3.5	Interchangeability	18
3.3.6	Safety	18
3.3.7	Human Engineering	18
3.3.8	Security	18
3.3.9	Property Issues	18
3.4	Documentation	18
3.5	Logistics	19
3.6	Personnel and Training	19

3.7	Major Component Characteristics	19
3.8	Precedence	19
3.9	Qualification	19
3.10	Samples	19
4.	QUALITY ASSURANCE PROVISIONS	20
4.1	Responsibility for Inspection	20
4.2	Special Tests and Inspections	20
4.3	Quality Conformance Inspections	20
5.	PREPARATION FOR DELIVERY	21
5.1	Preservation and Packaging	21
5.2	Packing	21
5.3	Marking for Shipment	21
6.	NOTES	21
6.1	Intended Use	21
6.2	Ordering Data	21
6.3	Use of Documents	21
6.4	Destination of Goods	22
6.5	Further Procurements	22
7.	APPENDIX	22

<b>Section 3</b>	<b>Title</b>	<b>Page</b>
1.	SCOPE	24
2.	APPLICABLE DOCUMENTS	24
2.1	Governmental	24
2.1.1	Specifications	24
2.1.2	Standards	24
2.1.3	Drawings	24
2.1.4	Procedures	24
2.1.5	Publications	24
2.1.6	Other Documents	24
2.2	Non Governmental	25
2.2.1	Specifications	25
2.2.2	Standards	25
2.2.3	Drawings	25
2.2.4	Procedures	25
2.2.5	Publications	25
2.2.6	Other Documents	25
3.	REQUIREMENTS	26
3.1	Definition	26
3.2	Characteristics	26
3.2.1	Performance Characteristics	26
3.2.2	Physical Characteristics	26
3.2.3	Reliability	27
3.2.4	Maintainability	27
3.2.5	Environmental Conditions	27
3.2.6	Transportability	27
3.3	Design and Construction	27
3.3.1	Materials, Parts and Processes	27
3.3.1.1	Toxic Products	28
3.3.1.2	Parts	28
3.3.2	Electromagnetic Interference	28
3.3.3	Nameplates and Product Marking	28

3.3.4	Workmanship	28
3.3.5	Interchangeability	28
3.3.6	Safety	28
3.3.7	Human Engineering	28
3.3.8	Security	28
3.3.9	Property Issues	28
3.4	Documentation	28
3.5	Logistics	29
3.6	Personnel and Training	29
3.7	Major Component Characteristics	29
3.8	Precedence	29
3.9	Qualification	29
3.10	Samples	29
4.	QUALITY ASSURANCE PROVISIONS	30
4.1	Responsibility for Inspection	30
4.2	Special Tests and Inspections	30
4.3	Quality Conformance Inspections	30
5.	PREPARATION FOR DELIVERY	31
5.1	Preservation and Packaging	31
5.2	Packing	31
5.3	Marking for Shipment	31
6.	NOTES	31
6.1	Intended Use	31
6.2	Ordering Data	31
6.3	Use of Documents	31
6.4	Destination of Goods	32
6.5	Further Procurements	32
7.	APPENDIX	32

## LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1	CBWR_26FLT01_001, 26-wires Near-coaxial Ribbon Flat Cable	33
2	CBWR_18FLT01_001, 18-wires Near-coaxial Ribbon Flat Cable - Outline	34
3	CBWR_18FLT01_001, 18-wires Near-coaxial Ribbon Flat Cable - Detail	35
4	CBWR_16FLT01_001, 18-wires Near-coaxial Ribbon Flat Cable - Outline	36

## ABBREVIATIONS AND ACRONYMS

AMS	Alpha Magnetic Spectrometer
CERN	Centro Europeo per la Ricerca Nucleare
INFN	Istituto Nazionale di Fisica Nucleare
ISS	International Space Station
STS	Shuttle Transportation System
QUP	Quality per Unit Pack
COC	Certificate of Compliance
IPTR	In-Process Test Report
ATR	Acceptance Test Report
PCKL	Packing List
UPILEX	Metallised Substrate
SOW	State Of Work
PO	Purchase Order
TBD	To Be Defined
NAP	Not Applicable
NPR	Not Prescribed
OHSMS	Occupational Health and Safety Management System
PFAR	Production Final Acceptance Report
QMP	Quality Management Plan
PRSP	Product Specification
TML	Total Mass Loss
CVCM	Colletted Volatile Condensed Material
LADDER	Assembly of silicon detectors and readout electronics on a ladder-shaped reinforcement

## SECTION 1

### 1. SCOPE

This document defines procurement/performance specifications and then technical characteristics and manufacturing specifications for the cable employed in manufacturing of cable assemblies, flight version. Said cables are used as interconnection between the ladder assembly (front end hybrid) and the readout electronics (TDR). In the ambit of the same project, such a cable is also employed for the fabrication of the saver and test versions of cable assemblies, testing tools used during testing and debugging of the system before the mission phase.

The cable is a 0.050 inches ribbon near-coaxial flat cable.

Requirements for testing, packing, storage and shipment are here defined too.

### 2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. When this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels (including date of revision) of said documents should be specified in the Solicitation/State of Work/Contract or Purchasing Order.

#### 2.1 Governmental

##### 2.1.1 Specifications NAP.

##### 2.1.2 Standards NAP.

##### 2.1.3 Drawings NAP.

##### 2.1.4 Procedures NAP.

##### 2.1.5 Publications NAP.

##### 2.1.6 Other Documents NAP.

#### 2.2 Non-Governmental

##### 2.2.1 Specifications NAP.

##### 2.2.2 Standards NAP.

##### 2.2.3 Drawings NAP.



## 2.2.4 Procedures

NAP.

## 2.2.5 Publications

NAP.

## 2.2.6 Other Documents

NAP.

### 3. REQUIREMENTS

In this section are indicated and defined as applicable the minimal requirements that the assemblies must comply with to be considered acceptable.

#### 3.1 Definition

The cable is a near-coaxial performance ribbon cable showing 26 wires (0.050 inches pitch) completely shielded by a copper foil. It shows two types of conductors: signal conductors (near-coaxial signal wires) and ground conductor (drain wires). Insulation and jacket material is GORE-TEX<sup>®</sup> expanded PTFE. Figure 1 represents the cable section.

The characteristic impedance is 50 $\Omega$   $\pm$ 10%, measured from each (coaxial) signal wire to the integrated copper shield. Size of conductors and their location are the following:

Signal Wire:	AWG30 (01)	Position from 2 to 17, from 19 to 21, from 23 to 25
Drain Wire:	AWG28 (07/36)	Position 1, 22, 18, 26

#### 3.2 Characteristics

##### 3.2.1 Performance Characteristics

Cable must meet the following performance characteristics:

- |   |                                 |
|---|---------------------------------|
| a) Voltage rating:  | 90Vrms                          |
| b) Characteristic Impedance:  | 50 $\Omega$ $\pm$ 5% single end |
| c) Capacitance:   | 85pF/m nominal                  |
| d) Velocity of Propagation:   | 79%                             |
| e) Time Delay:  | 4.2ns/m                         |
| f) Effective Dielectric Constant:   | 1.55                            |
| g) Crosstalk, L=3m, GSG, Differential Pair, One line driven, Rise time 1,0nsec    | near end <2%<br>far end <3%     |
| h) Crosstalk, L=3m, GGSSGG, Differential Pair, One line driven, Rise time 1,0nsec | near end <2%<br>far end <3%     |
| i) Crosstalk, L=3m, GSG, Single ended, One line driven, Rise time 1,0nsec         | near end <2%<br>far end <3%     |
| j) ePTFE outgassing TML (Total Mass Loss):  | 0.13% typical                   |
| k) ePTFE outgassing CVCM (Collected Volatile Condensed Material):                 | 0.02% typical                   |

Crosstalk testing are performed in accordance with methods of MIL-C-17, IPC-FC-201 and IPC-FC-224 where applicable.

Outgassing values refers only to the materials, not to the cable construction.

##### 3.2.2 Physical Characteristics

Cable dimensions must respect the physical requirements shown in figure 1.

The cable to be ordered can be supplied possible in one only sizing. When the sizing has different lengths the single length must be not shorter than 6 meters. If junctions have been realized along the cable, the minimum length of an integral piece cannot be shorter than 6 meters.

##### 3.2.3 Reliability

NPR.

##### 3.2.4 Maintainability

NPR.

##### 3.2.5 Environmental Conditions

The following environmental condition must be respected:

Operating temperature: from -55°C to +125°C

### 3.2.6 Transportability

The cable must be transported exclusively in the packing prescribed. The shipment must comply with standard procedures applied by common international carriers. The shipment must be covered by a specific insurance against total or partial damage or loss, for the nominal value of the contract.

### 3.3 Design and Construction

For requirements not covered by this document, manufacturer standard procedures are applicable. ISO 9002 requirements and prescriptions must be applied.

#### 3.3.1 Materials, Parts and Processes

##### Conductors

Conductor material is silver-plated copper.

##### Insulator

Insulator material is composite GORE-TEX? ePTFE (expanded polytetrafluoroethylene), white colored.

##### Shield

Shield material is perforated copper foil.

##### Jacket

Jacket material is a composite GORE-TEX? ePTFE (expanded polytetrafluoroethylene) insulator, gray colored. Over the jacket, along the side of the cable, a white trace must be marked in correspondence of wire #1.

#### 3.3.1.1 Toxic Products

NAP.

#### 3.3.1.2 Parts

NAP.

### 3.3.2 Electromagnetic Interference

NPR.

### 3.3.3 Nameplates and Product Markings

Pin #1 identifier must be realized by marking a white stripe along the whole cable.

Products must be named in accordance to the following coding):

manufacturer identifier (p/n)

purchase code (p/n):

GSC-06-6420-00

CBWR\_26FLT01\_001

The manufacturer must univocally identify the product (directly or indirectly) by using the purchase code.

### 3.3.4 Workmanship

Products must be free of manufacturing defects. Unless otherwise herein prescribed, manufacturing must be in accordance with manufacturer quality standards. Testing, inspections and quality verifications trace ability must be assured and the documentation not included in the shipping must be available on request.

### 3.3.5 Interchangeability

The cable, object of this specification, must be interchangeable.

### 3.3.6 Safety

NPR.

### 3.3.7 [Human Engineering](#)

NAP.

### 3.3.8 [Security](#)

NPR.

### 3.3.9 [Property Issues](#)

The production executed by means of this specification, including specific tools and equipment developed and/or purchased for testing or characterization, the software and hardware acquired, the results, drawings and all related documentation realized and/or acquired in the ambit of the contract, will be property of Agenzia Spaziale Italiana.

### 3.4 [Documentation](#)

During procurement and manufacture activities the following documents must be issued.

Issued by procurement office:

- a) purchase order
- b) in-process test report: record of acceptance tests with reference to p/n and s/n
- c) acceptance report
- d) certificate of compliance
- e) packing list

Issued by manufacturer:

- a) final inspection report
- b) certificate of compliance
- c) packing list

### 3.5 [Logistics](#)

During manufacturing phases, in particular: incoming and storage of materials, fabrication, testing, packing and outcoming must be applied the standard logistic requirements for a plant certified ISO 9002.

### 3.6 [Personnel and Training](#)

NAP.

### 3.7 [Major Component Characteristics](#)

NAP.

### 3.8 [Precedence](#)

This specification has precedence over applicable documents. Any conflict must be notified to the procurement office in order to achieve a full resolution. Resolved conflicts must be formalized by a revision of this specification.

### 3.9 [Qualification](#)

The product qualification is responsibility of procurement office; the product is qualified after passing the incoming inspection and acceptance tests. Only the products certified compliant by manufacturer will be submitted to qualification procedure.

### 3.10 [Samples](#)

NPR.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

The manufacturer is responsible for the performances and for all of the inspections and tests provided in the manufacturing procedure. The manufacturer may use its own facilities or any external commercial laboratory to assure the good execution of the supplies. The responsible of the procurement reserves the right to perform any of the inspections and tests where such inspections and tests are deemed necessary to ensure supplies and services conform to requirements herein specified.

### 4.2 Special Tests and Inspections

The manufacturer must perform the following tests over the whole production:

- a) visual inspection
- b) dimensional inspection
- c) spark test
- d) voltage test
- e) continuity test
- f) capacitance check
- g) impedance check

### 4.3 Quality Conformance Inspections

According to the requirements contained in this specification and with reference to the prescribed documents shipped from the manufacturer together with the goods, the procurement office must apply the following prescriptions recording results on the “procurement in-process test report”.

- a) verification that final inspection report and certificate of compliance are included with the product (record and date)
- b) packing inspection (record and date)
- c) incoming of products
- d) product visual inspection (record and date)
- e) moving of products in shipping area, packing and preparation for shipment (record and date)
- f) approval, date and signature

## 5. PREPARATION FOR DELIVERY

### 5.1 Preservation and Packaging

The product must be stored in a standard industrial environment with packing of level B.

The product must be protected by the packing of level A for shipment or for storage ante/post shipment. The following documents must be included into the pack:

For shipment executed by the supplier

- a) final inspection report
- b) certificate of compliance
- c) packing list

For shipment executed by the procurement office

- a) certificate of compliance
- b) packing list

Copy of the Acceptance Report must be attached to the invoice and send to Agenzia Spaziale Italiana.

The cable is packed in the manufacturer standard spools. The spools or the collected single pieces must be protected against external contamination by means of a sealed transparent plastic envelopes or equivalent (level B packing). The packed products must be contained into cardboard boxes (level A packing) to be used for shipment.

## 5.2 Packing

The packing consists of two levels.

### B level packing

a) transparent plastic bag

### A level packing

a) cardboard box

## 5.3 Marking for Shipment

The product must be identified at the different packing levels with labels. Such labels must show the data necessary to univocally and progressively identify any single assembly through purchase p/n and sizing.

## 6. NOTES

### 6.1 Intended Use

Products object of this specification will be used for the fabrication of cable assemblies used in the silicon tracker subsystem of AMS program, phase C/D.

### 6.2 Ordering data

The purchasing order must be sent to W.L. Gore & Associates GmbH, Nordring 1, D-91785 Pleinfeld, Germany. General conditions of supplies, material quantities, delivery and costs must be defined in the order. The purchasing order must refer to this document as integral part of itself and as applicable document.

The supplied quantity can be equal to the ordered quantity +10% -0.

Supplies are free of VAT and custom fees according to Italian: art.8bis, lettera e) of D.P.R. 26/10/1972 No.633 and following modifications (certificated by Agenzia Spaziale Italiana).

### 6.3 Use of Documents

This document must be considered confidential for industrial aspects and contains proprietary information and neither the document nor the said proprietary information shall be published, reproduced, copied, or disclosed without the express write permission of a duly authorized representative of one of the subscriber parts.

### 6.4 Destination of Goods

The manufacturer must ship the goods at the address of G & A Engineering s.r.l., plant of Oricola AQ – Italy.

The goods purchased by G & A Engineering s.r.l. must be consigned to Agenzia Spaziale Italiana with destination Site Technology s.r.l., Oricola AQ - Italy.

### 6.5 Further Procurements

The manufacturer commits itself to accept further orders of any volume for a period not inferior to 3 years in compliance of the requirements of this specification.

## 7. APPENDIX

Not applicable.

## SECTION 2

### 1. SCOPE

This document defines procurement/performance specifications and then technical characteristics and manufacturing specifications for the cable employed in manufacturing of cable assemblies, flight version, S side type. Said cables are used as interconnection between the ladder assembly (front end hybrid) and the readout electronics (TDR).

The cable is a 0.050 inches ribbon near-coaxial flat cable.

In the following requirements for testing, packing, storage and shipment have been defined too.

### 2. APPLICABLE DOCUMENTS

The following documents form part of this specification to the extent specified herein. When this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels (including date of revision) of said documents should be specified in the Solicitation/State of Work/Contract or Purchasing Order.

#### 2.1 Governmental

##### 2.1.1 Specifications

Agenzia Spaziale Italiana, ASI

I/006/01/0

Contratto, 30 Gennaio 2001

Programma AMS

Sottosistema Tracciatore al Silicio

European Space Agency, ESA

ESA/SCC No. 20600

Preservation, Packaging and Dispatch of SCC Electronic Components

##### 2.1.2 Standards

John F. Kennedy Space Center (KSC), NASA

KSC-STD-P-0001B

Preparation of Equipment or System Procurement/Performance Specifications, Standard for

##### 2.1.3 Drawings

NAP.

##### 2.1.4 Procedures

NAP.

##### 2.1.5 Publications

National Aeronautics and Space Administration (NASA)

NHB 6000.1

Requirement for Packing, Handling, and Transportation for Aeronautical and Space System, Equipment, and Associated Components

KSC-DF-107

DE Technical Documentation Style Guide

##### 2.1.6 Other Documents

NAP.

## 2.2 [Non-Governmental](#)

### 2.2.1 [Specifications](#) NAP.

### 2.2.2 [Standards](#) NAP.

### 2.2.3 [Drawings](#) NAP.

### 2.2.4 [Procedures](#) NAP.

### 2.2.5 [Publications](#) NAP.

### 2.2.6 [Other Documents](#) NAP.



### 3. REQUIREMENTS

In this section are indicated and defined as applicable the minimal requirements that cable must comply with to be considered acceptable.

#### 3.1 Definition

The cable is a 50 $\Omega$  near-coaxial performance ribbon cable showing 18 wires (0.050 inches pitch) completely shielded by a perforated copper foil (red copper). It shows three types of conductors: signal conductors (near-coaxial signal wires), power conductors (near-coaxial power wires) and ground conductor (drain wires). Insulation and jacket material is GORE-TEX $\text{\textregistered}$  expanded PTFE. Figures 2 and 3 represent the cable section.

#### 3.2 Characteristics

##### 3.2.1 Performance Characteristics

Cable must meet the following performance characteristics:

a) Voltage rating: Coaxial Signal-to-Integrated Shield Integrated Shield-to-Outer Insulation Dielectric Withstanding Voltage Insulation Resistance	90Vrms 300Vrms 500Vrms minimum 500M $\Omega$ m/1000 ft. minimum
b) Characteristic Impedance (signal wire):	50 $\Omega$ $\pm$ 5% single end
c) Capacitance:	85pF/m nominal
d) Velocity of Propagation:	79%
e) Signal wires, Attenuation dB/10 ft 50 $\Omega$ m impedance (frequency 500MHz)	-2.8dB
e) Power wires, Attenuation dB/10 ft 50 $\Omega$ m impedance (frequency 500MHz)	<2.8dB
e) Time Delay:	4.2ns/m
f) Effective Dielectric Constant:	1.55
g) Crosstalk, L=3m, GSG, Differential Pair, One line driven, Rise time 1,0nsec	near end <2% far end <3%
h) Crosstalk, L=3m, GGSSGG, Differential Pair, One line driven, Rise time 1,0nsec	near end <2% far end <3%
i) Crosstalk, L=3m, GSG, Single ended, One line driven, Rise time 1,0nsec	near end <2% far end <3%
j) ePTFE outgassing TML (Total Mass Loss):	0.13% typical
k) ePTFE outgassing CVCM (Collected Volatile Condensed Material):	0.02% typical

Crosstalk testing are performed in accordance with methods of MIL-C-17, IPC-FC-201 and IPC-FC-224 where applicable.

The characteristic impedance of signal wires is 50 $\Omega$   $\pm$ 10%, measured from each (coaxial) signal wire to the integrated copper shield; for power wires it is lower than 50 $\Omega$  .

##### 3.2.2 Physical Characteristics

Cable dimensions must respect the physical requirements shown in figure 2.

The cable to be ordered should be supplied, when possible, in one only sizing. When sizing have different lengths the single length must be not shorter than 6 meters. If junctions have been realized along the cable, the minimum length of an integral piece cannot be shorter than 6 meters.

Characteristics of conductors and their location are in the following table:

Description	AWG size & stranding	Resistance Ohm/km @ 20°C	Positions
Type A - Signal Wire	AWG30 (01)	361	2, 5, 6, 7, 8, 10, 13, 14, 16, 17
Type B - Supply Wire	AWG28 (01)	230	3, 4, 9, 11, 12, 15
Type C - Drain Wire	AWG28 (07/36)	215	1, 18

Weight of each part of the cable have been indicated below:

Q.ty	Description	Weight [grams/meter]	
		unit	total
8	Awg28 wire	0,83	6,64
10	Awg30 wire, insulator included	0,52	5,20
1	White Insulator	8,15	8,15
2	Copper Shield	5,11	10,22
2	External Sheath (0,004" thickness)	7,00	13,99
Total weight [g/m]			44,20

The *nominal weight* of the cable is 45g/m and the *maximum weight* is not greater than 49g/m.  
The *nominal thickness* is 0.96mm and the *maximum thickness* is 1.02mm along all of the cable.  
*Minimum bending radius* is 1mm without degradation of electrical and mechanical performances;  
continuous folding of the cable back and for of 180° can cause change of electrical performances.

### 3.2.3 Reliability

NPR.

### 3.2.4 Maintainability

NPR.

### 3.2.5 Environmental Conditions

The following environmental condition must be respected:

Operating temperature: from -55°C to +125°C

### 3.2.6 Transportability

The cable must be transported exclusively in the packing prescribed. The shipment must comply with standard procedures applied by common international carriers. The shipment must be covered by a specific insurance against total or partial damage or loss, for the nominal value of the contract.

## 3.3 Design and Construction

For requirements not covered by this document, manufacturer standard procedures are applicable. ISO 9002 requirements and prescriptions must be applied.

### 3.3.1 Materials, Parts and Processes

#### Conductors

Conductor material is silver-plated copper.

#### Insulator

Insulator material is composite GORE-TEX? ePTFE (expanded polytetrafluoroethylene), white colored.

#### Shield

Shield material is perforated red copper foil.

## Jacket

Jacket material is a composite GORE-TEX? ePTFE (expanded polytetrafluoroethylene) insulator, gray colored. Over the jacket, along the side of the cable, a white trace must be marked in correspondence of wire #1.

### 3.3.1.1 Toxic Products

The product itself does not contain nor produces toxic or contaminant substances. During manufacturing process should be applied ISO 14001 requirements and prescriptions.

### 3.3.1.2 Parts

NAP.

### 3.3.2 Electromagnetic Interference

NPR.

### 3.3.3 Nameplates and Product Markings

Pin #1 identifier must be realized by marking a white stripe along the whole cable.

Products must be named in accordance to the following coding:

manufacturer identifier (p/n)

GSC-06-6677-01

purchase code (p/n):

CBWR\_18FLT02\_001

The manufacturer must univocally identify the product (directly or indirectly) by using the purchase code.

### 3.3.4 Workmanship

Products must be free of manufacturing defects. Unless otherwise herein prescribed, manufacturing must be in accordance with manufacturer quality standards. Testing, inspections and quality verifications trace ability must be assured and the documentation not included in the shipping must be available on request.

### 3.3.5 Interchangeability

The cable, object of this specification, must be interchangeable.

### 3.3.6 Safety

NPR.

### 3.3.7 Human Engineering

NAP.

### 3.3.8 Security

NPR.

### 3.3.9 Property Issues

The production executed by means of this specification, including specific tools and equipment developed and/or purchased for testing or characterization, the software and hardware acquired, the results, drawings and all related documentation realized and/or acquired in the ambit of the contract, will be property of Agenzia Spaziale Italiana.

## 3.4 Documentation

During procurement and manufacture activities the following documents must be issued.

Issued by procurement office:

- f) purchase order
- g) in-process test report: record of acceptance tests with reference to p/n and s/n
- h) acceptance report

- i) certificate of compliance
  - j) packing list
- Issued by manufacturer:
- d) final inspection report
  - e) certificate of compliance
  - f) packing list

### 3.5 [Logistics](#)

During manufacturing phases, in particular: incoming and storage of materials, fabrication, testing, packing and outcoming must be applied the standard logistic requirements for a plant certified ISO 9002.

### 3.6 [Personnel and Training](#)

NAP.

### 3.7 [Major Component Characteristics](#)

NAP.

### 3.8 [Precedence](#)

This specification has precedence over applicable documents. Any conflict must be notified to the procurement office in order to achieve a full resolution. Resolved conflicts must be formalized by a revision of this specification.

### 3.9 [Qualification](#)

The product qualification is responsibility of procurement office; the product is qualified after passing the incoming inspection and acceptance tests. Only the products certified compliant by manufacturer will be submitted to qualification procedure.

### 3.10 [Samples](#)

NPR.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

The manufacturer is responsible for the performances and for all of the inspections and tests provided in the manufacturing procedure. The manufacturer may use its own facilities or any external commercial laboratory to assure the good execution of the supplies. The responsible of the procurement reserves the right to perform any of the inspections and tests where such inspections and tests are deemed necessary to ensure supplies and services conform to requirements herein specified.

### 4.2 Special Tests and Inspections

The manufacturer must perform the following tests over the whole production:

- h) visual inspection
- i) dimensional inspection
- j) spark test
- k) voltage test
- l) continuity test
- m) capacitance check
- n) impedance check

### 4.3 Quality Conformance Inspections

According to the requirements contained in this specification and with reference to the prescribed documents shipped from the manufacturer together with the goods, the procurement office must apply the following prescriptions recording results on the “procurement in-process test report”.

- g) verification that final inspection report and certificate of compliance are included with the product (record and date)
- h) packing inspection (record and date)
- i) incoming of products
- j) product visual inspection (record and date)
- k) moving of products in shipping area, packing and preparation for shipment (record and date)
- l) approval, date and signature

## 5. PREPARATION FOR DELIVERY

### 5.1 Preservation and Packaging

The product must be stored in a standard industrial environment with packing of level B.

The product must be protected by the packing of level A for shipment or for storage ante/post shipment.

The following documents must be included into the pack:

For shipment executed by the supplier

- d) final inspection report
- e) certificate of compliance
- f) packing list

For shipment executed by the procurement office

- c) acceptance report
- d) certificate of compliance
- e) packing list

The cable is packed in the manufacturer standard spools. The spools or the collected single pieces must be protected against external contamination by means of a sealed transparent plastic envelopes or equivalent (level B packing). The packed products must be contained into cardboard boxes (level A packing) to be used for shipment.

### 5.2 Packing

The packing consists of two levels.

B level packing

- b) transparent plastic bag

A level packing

- b) cardboard box

### 5.3 Marking for Shipment

The product must be identified at the different packing levels with labels. Such labels must show the data necessary to univocally and progressively identify any single assembly through purchase p/n and sizing.

## 6. NOTES

### 6.1 Intended Use

Products object of this specification will be used for the fabrication of cable assemblies used in the silicon tracker subsystem of AMS program, phase C/D.

### 6.2 Ordering data

The purchasing order must be sent to W.L. Gore & Associates GmbH, Nordring 1, D-91785 Pleinfeld, Germany. General conditions of supplies, material quantities, delivery and costs must be defined in the order. The purchasing order must refer to this document as integral part of itself and as applicable document.

The supplied quantity can be equal to the ordered quantity +10% -0.

Supplies are free of VAT and custom fees according to Italian: art.8bis, lettera e) of D.P.R. 26/10/1972 No.633 and following modifications (certificated by Agenzia Spaziale Italiana).

### 6.3 Use of Documents

This document must be considered confidential for industrial aspects and contains proprietary information and neither the document nor the said proprietary information shall be published, reproduced, copied, or disclosed without the express write permission of a duly authorized representative of one of the subscriber parts.

## 6.4 Destination of Goods

The manufacturer must ship the goods at the address of G & A Engineering s.r.l., plant of Oricola AQ – Italy.

The goods purchased by G & A Engineering s.r.l. must be consigned to Agenzia Spaziale Italiana with destination Site Technology s.r.l., Oricola AQ - Italy.

## 6.5 Further Procurements

The manufacturer commits itself to accept further orders of any volume for a period not inferior to 3 years in compliance of the requirements of this specification.

## 7. APPENDIX

Not applicable.

## SECTION 3

### 1. SCOPE

This document defines procurement/performance specifications and then technical characteristics and manufacturing specifications for the cable employed in manufacturing of cable assemblies, flight version, K side type. Said cables are used as interconnection between the ladder assembly (front end hybrid) and the readout electronics (TDR).

The cable is a 0.050 inches ribbon near-coaxial flat cable.

In the following requirements for testing, packing, storage and shipment have been defined too.

### 2. APPLICABLE DOCUMENTS

The following documents form part of this specification to the extent specified herein. When this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels (including date of revision) of said documents should be specified in the Solicitation/State of Work/Contract or Purchasing Order.

#### 2.1 Governmental

##### 2.1.1 Specifications

Agenzia Spaziale Italiana, ASI

I/006/01/0

Contratto, 30 Gennaio 2001

Programma AMS

Sottosistema Tracciatore al Silicio

European Space Agency, ESA

ESA/SCC No. 20600

Preservation, Packaging and Dispatch of SCC Electronic Components

##### 2.1.2 Standards

John F. Kennedy Space Center (KSC), NASA

KSC-STD-P-0001B

Preparation of Equipment or System Procurement/Performance Specifications, Standard for

##### 2.1.3 Drawings

NAP.

##### 2.1.4 Procedures

NAP.

##### 2.1.5 Publications

National Aeronautics and Space Administration (NASA)

NHB 6000.1

Requirement for Packing, Handling, and Transportation for Aeronautical and Space System, Equipment, and Associated Components

KSC-DF-107

DE Technical Documentation Style Guide

##### 2.1.6 Other Documents

NAP.



## 2.2 [Non-Governmental](#)

### 2.2.1 [Specifications](#) NAP.

### 2.2.2 [Standards](#) NAP.

### 2.2.3 [Drawings](#) NAP.

### 2.2.4 [Procedures](#) NAP.

### 2.2.5 [Publications](#) NAP.

### 2.2.6 [Other Documents](#) NAP.

### 3. REQUIREMENTS

In this section are indicated and defined as applicable the minimal requirements that cable must comply with to be considered acceptable.

#### 3.1 Definition

The cable is a 50 $\Omega$  near-coaxial performance ribbon cable showing 16 wires (0.050 inches pitch) completely shielded by a perforated copper foil (red copper). It shows three types of conductors: signal conductors (near-coaxial signal wires), power conductors (near-coaxial power wires) and ground conductor (drain wires). Insulation and jacket material is GORE-TEX $\text{\textregistered}$  expanded PTFE. Figures 2 and 3 represent the cable section.

#### 3.2 Characteristics

##### 3.2.1 Performance Characteristics

Cable must meet the following performance characteristics:

a) Voltage rating: Coaxial Signal-to-Integrated Shield Integrated Shield-to-Outer Insulation Dielectric Withstanding Voltage Insulation Resistance	90Vrms 300Vrms 500Vrms minimum 500MOhm/1000 ft. minimum
b) Characteristic Impedance (signal wire):	50 $\Omega$ $\pm$ 5% single end
c) Capacitance:	85pF/m nominal
d) Velocity of Propagation:	79%
e) Signal wires, Attenuation dB/10 ft 50Ohm impedance (frequency 500MHz)	-2.8dB
e) Power wires, Attenuation dB/10 ft 50Ohm impedance (frequency 500MHz)	<2.8dB
e) Time Delay:	4.2ns/m
f) Effective Dielectric Constant:	1.55
g) Crosstalk, L=3m, GSG, Differential Pair, One line driven, Rise time 1,0nsec	near end <2% far end <3%
h) Crosstalk, L=3m, GGSSGG, Differential Pair, One line driven, Rise time 1,0nsec	near end <2% far end <3%
i) Crosstalk, L=3m, GSG, Single ended, One line driven, Rise time 1,0nsec	near end <2% far end <3%
j) ePTFE outgassing TML (Total Mass Loss):	0.13% typical
k) ePTFE outgassing CVCM (Collected Volatile Condensed Material):	0.02% typical

Crosstalk testing are performed in accordance with methods of MIL-C-17, IPC-FC-201 and IPC-FC-224 where applicable.

The characteristic impedance of signal wires is 50 $\Omega$   $\pm$ 10%, measured from each (coaxial) signal wire to the integrated copper shield; for power wires it is lower than 50 $\Omega$  .

##### 3.2.2 Physical Characteristics

Cable dimensions must respect the physical requirements shown in figure 4.

The cable to be ordered should be supplied, when possible, in one only sizing. When sizing have different lengths the single length must be not shorter than 6 meters. If junctions have been realized along the cable, the minimum length of an integral piece cannot be shorter than 6 meters.

Characteristics of conductors and their location are in the following table:

Description	AWG size & stranding	Resistance Ohm/km @ 20°C	Positions
Type A - Signal Wire	AWG30 (01)	361	2, 5, 6, 7, 8, 10, 13, 14
Type B - Supply Wire	AWG28 (01)	230	3, 4, 9, 11, 12, 15
Type C - Drain Wire	AWG28 (07/36)	215	1, 16

Weight of each part of the cable have been indicated below:

Q.ty	Description	Weight [grams/meter]	
		unit	total
8	Awg28 wire	0,83	6,64
8	Awg30 wire, insulator included	0,52	4,16
1	White Insulator	7,37	7,37
2	Copper Shield	4,62	9,24
2	External Sheath (0,004" thickness)	6,39	12,78
Total weight [g/m]			40,19

The *nominal weight* of the cable is than 40g/m and the *maximum weight* is not greater than 44g/m. The *nominal thickness* is 0.96mm and the *maximum thickness* is 1.02mm along all of the cable. *Minimum bending radius* is 1mm without degradation of electrical and mechanical performances; continuous folding of the cable back and for of 180° can cause change of electrical performances.

### 3.2.3 [Reliability](#)

NPR.

### 3.2.4 [Maintainability](#)

NPR.

### 3.2.5 [Environmental Conditions](#)

The following environmental condition must be respected:

Operating temperature: from -55°C to +125°C

### 3.2.6 [Transportability](#)

The cable must be transported exclusively in the packing prescribed. The shipment must comply with standard procedures applied by common international carriers. The shipment must be covered by a specific insurance against total or partial damage or loss, for the nominal value of the contract.

## 3.3 [Design and Construction](#)

For requirements not covered by this document, manufacturer standard procedures are applicable. ISO 9002 requirements and prescriptions must be applied.

### 3.3.1 [Materials, Parts and Processes](#)

#### [Conductors](#)

Conductor material is silver-plated copper.

#### [Insulator](#)

Insulator material is composite GORE-TEX? ePTFE (expanded polytetrafluoroethylene), white colored.

#### [Shield](#)

Shield material is perforated red copper foil.

## Jacket

Jacket material is a composite GORE-TEX? ePTFE (expanded polytetrafluoroethylene) insulator, gray colored. Over the jacket, along the side of the cable, a white trace must be marked in correspondence of wire #1.

### 3.3.1.1 Toxic Products

The product itself does not contain nor produces toxic or contaminant substances. During manufacturing process should be applied ISO 14001 requirements and prescriptions.

### 3.3.1.2 Parts

NAP.

### 3.3.2 Electromagnetic Interference

NPR.

### 3.3.3 Nameplates and Product Markings

Pin #1 identifier must be realized by marking a white stripe along the whole cable.

Products must be named in accordance to the following coding:

manufacturer identifier (p/n)

GSC-06-6677-02

purchase code (p/n):

CBWR\_16FLT01\_001

The manufacturer must univocally identify the product (directly or indirectly) by using the purchase code.

### 3.3.4 Workmanship

Products must be free of manufacturing defects. Unless otherwise herein prescribed, manufacturing must be in accordance with manufacturer quality standards. Testing, inspections and quality verifications trace ability must be assured and the documentation not included in the shipping must be available on request.

### 3.3.5 Interchangeability

The cable, object of this specification, must be interchangeable.

### 3.3.6 Safety

NPR.

### 3.3.7 Human Engineering

NAP.

### 3.3.8 Security

NPR.

### 3.3.9 Property Issues

The production executed by means of this specification, including specific tools and equipment developed and/or purchased for testing or characterization, the software and hardware acquired, the results, drawings and all related documentation realized and/or acquired in the ambit of the contract, will be property of Agenzia Spaziale Italiana.

## 3.4 Documentation

During procurement and manufacture activities the following documents must be issued.

Issued by procurement office:

- k) purchase order
- l) in-process test report: record of acceptance tests with reference to p/n and s/n
- m) acceptance report

- n) certificate of compliance
  - o) packing list
- Issued by manufacturer:
- g) final inspection report
  - h) certificate of compliance
  - i) packing list

### 3.5 [Logistics](#)

During manufacturing phases, in particular: incoming and storage of materials, fabrication, testing, packing and outcoming must be applied the standard logistic requirements for a plant certified ISO 9002.

### 3.6 [Personnel and Training](#)

NAP.

### 3.7 [Major Component Characteristics](#)

NAP.

### 3.8 [Precedence](#)

This specification has precedence over applicable documents. Any conflict must be notified to the procurement office in order to achieve a full resolution. Resolved conflicts must be formalized by a revision of this specification.

### 3.9 [Qualification](#)

The product qualification is responsibility of procurement office; the product is qualified after passing the incoming inspection and acceptance tests. Only the products certified compliant by manufacturer will be submitted to qualification procedure.

### 3.10 [Samples](#)

NPR.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

The manufacturer is responsible for the performances and for all of the inspections and tests provided in the manufacturing procedure. The manufacturer may use its own facilities or any external commercial laboratory to assure the good execution of the supplies. The responsible of the procurement reserves the right to perform any of the inspections and tests where such inspections and tests are deemed necessary to ensure supplies and services conform to requirements herein specified.

### 4.2 Special Tests and Inspections

The manufacturer must perform the following tests over the whole production:

- o) visual inspection
- p) dimensional inspection
- q) spark test
- r) voltage test
- s) continuity test
- t) capacitance check
- u) impedance check

### 4.3 Quality Conformance Inspections

According to the requirements contained in this specification and with reference to the prescribed documents shipped from the manufacturer together with the goods, the procurement office must apply the following prescriptions recording results on the “procurement in-process test report”.

- m) verification that final inspection report and certificate of compliance are included with the product (record and date)
- n) packing inspection (record and date)
- o) incoming of products
- p) product visual inspection (record and date)
- q) moving of products in shipping area, packing and preparation for shipment (record and date)
- r) approval, date and signature

## 5. PREPARATION FOR DELIVERY

### 5.1 Preservation and Packaging

The product must be stored in a standard industrial environment with packing of level B.

The product must be protected by the packing of level A for shipment or for storage ante/post shipment.

The following documents must be included into the pack:

For shipment executed by the supplier

- g) final inspection report
- h) certificate of compliance
- i) packing list

For shipment executed by the procurement office

- f) acceptance report
- g) certificate of compliance
- h) packing list

The cable is packed in the manufacturer standard spools. The spools or the collected single pieces must be protected against external contamination by means of a sealed transparent plastic envelopes or equivalent (level B packing). The packed products must be contained into cardboard boxes (level A packing) to be used for shipment.

### 5.2 Packing

The packing consists of two levels.

B level packing

- c) transparent plastic bag

A level packing

- c) cardboard box

### 5.3 Marking for Shipment

The product must be identified at the different packing levels with labels. Such labels must show the data necessary to univocally and progressively identify any single assembly through purchase p/n and sizing.

## 6. NOTES

### 6.1 Intended Use

Products object of this specification will be used for the fabrication of cable assemblies used in the silicon tracker subsystem of AMS program, phase C/D.

### 6.2 Ordering data

The purchasing order must be sent to W.L. Gore & Associates GmbH, Nordring 1, D-91785 Pleinfeld, Germany. General conditions of supplies, material quantities, delivery and costs must be defined in the order. The purchasing order must refer to this document as integral part of itself and as applicable document.

The supplied quantity can be equal to the ordered quantity +10% -0.

Supplies are free of VAT and custom fees according to Italian: art.8bis, lettera e) of D.P.R. 26/10/1972 No.633 and following modifications (certificated by Agenzia Spaziale Italiana).

### 6.3 Use of Documents

This document must be considered confidential for industrial aspects and contains proprietary information and neither the document nor the said proprietary information shall be published, reproduced, copied, or disclosed without the express write permission of a duly authorized representative of one of the subscriber parts.

## 6.4 Destination of Goods

The manufacturer must ship the goods at the address of G & A Engineering s.r.l., plant of Oricola AQ – Italy.

The goods purchased by G & A Engineering s.r.l. must be consigned to Agenzia Spaziale Italiana with destination Site Technology s.r.l., Oricola AQ - Italy.

## 6.5 Further Procurements

The manufacturer commits itself to accept further orders of any volume for a period not inferior to 3 years in compliance of the requirements of this specification.

## 7. APPENDIX

Not applicable.

Custodian:

G & A Engineering s.r.l.

Località Miole, 100

67063 – ORICOLA, AQ

ITALY

[www.gaengineering.com](http://www.gaengineering.com)

email: [info@gaengineering.com](mailto:info@gaengineering.com)

Tel +39 0863 909003

Fax +39 0863 907616





## Figura 1

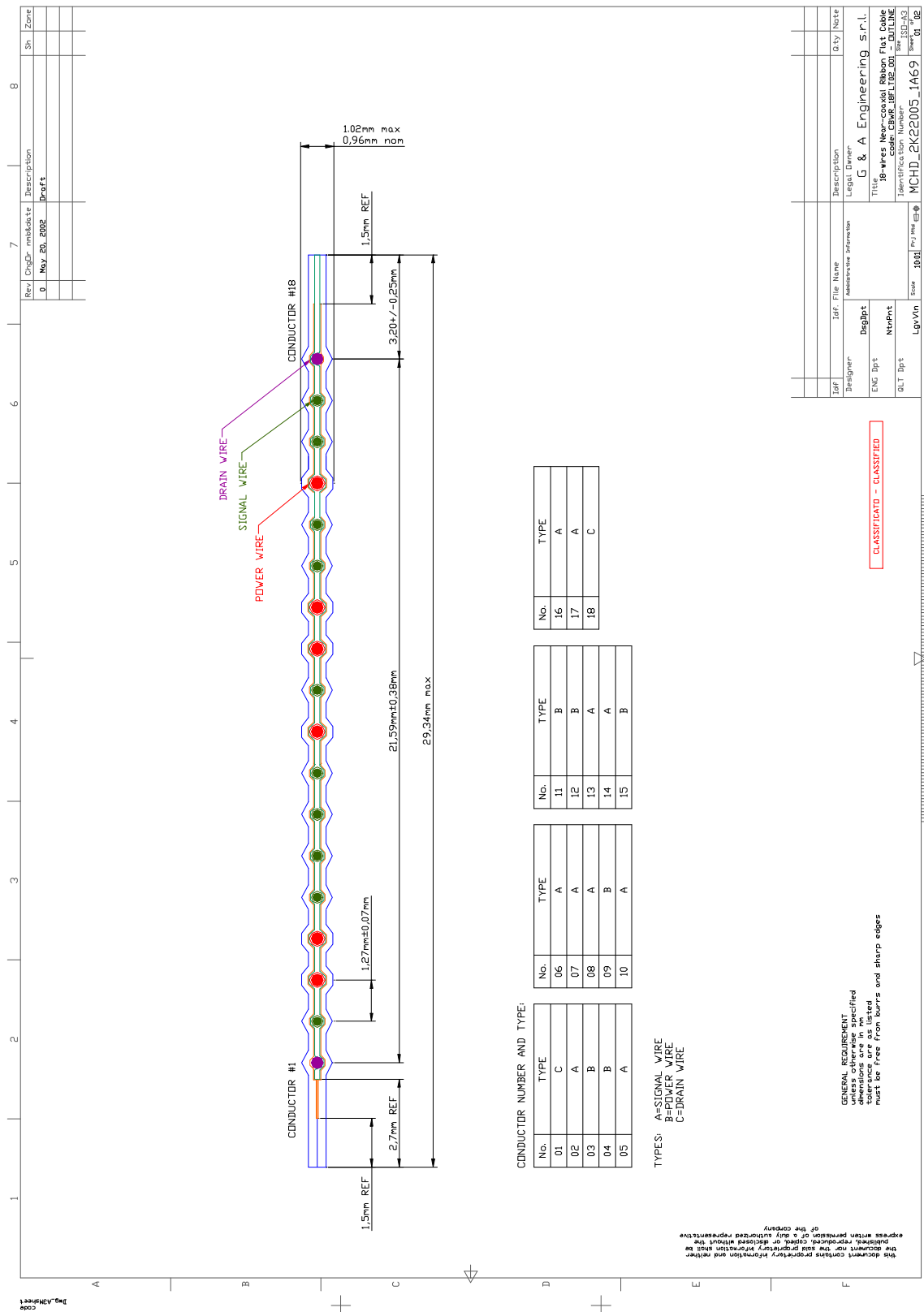


Figure 2

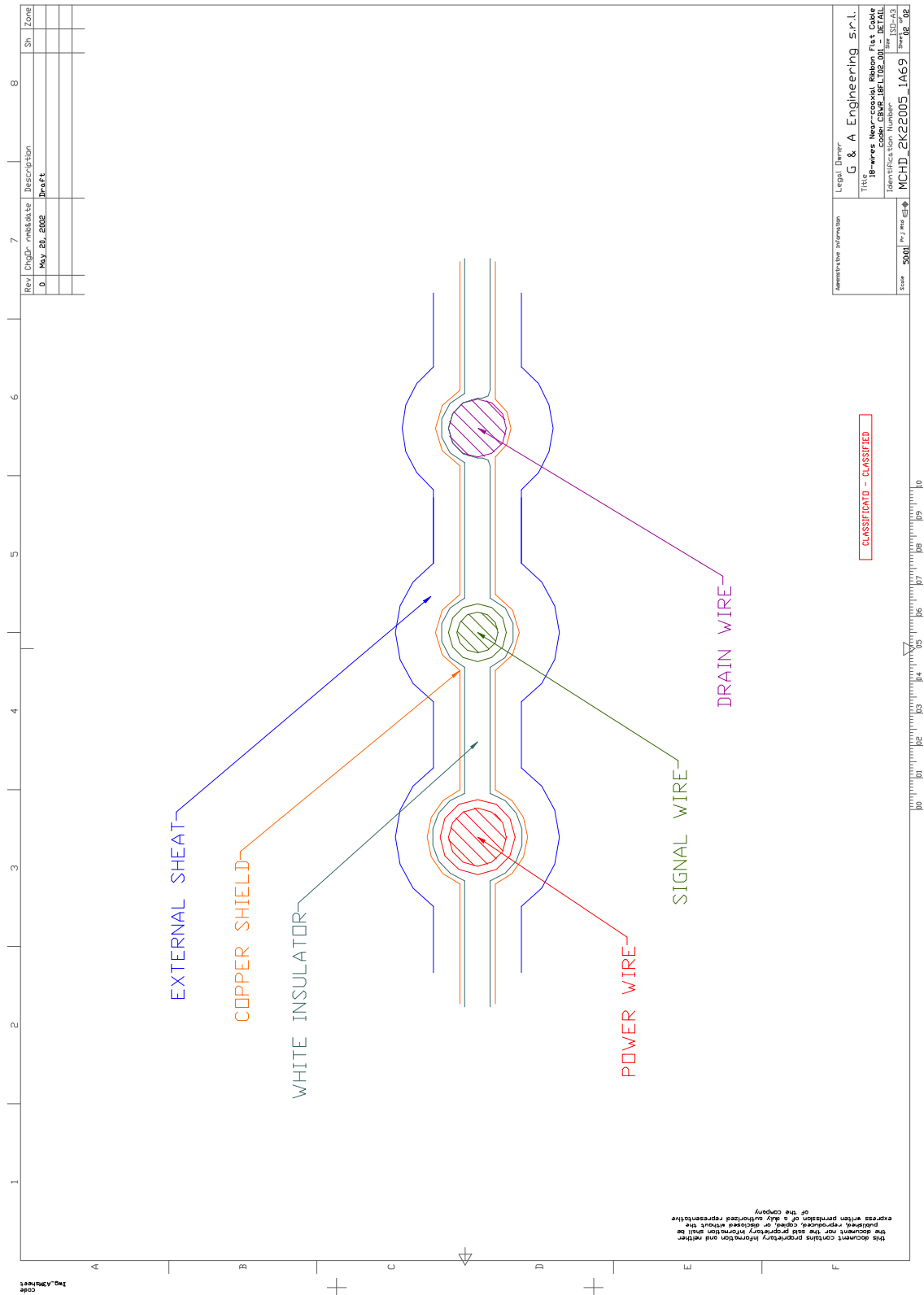
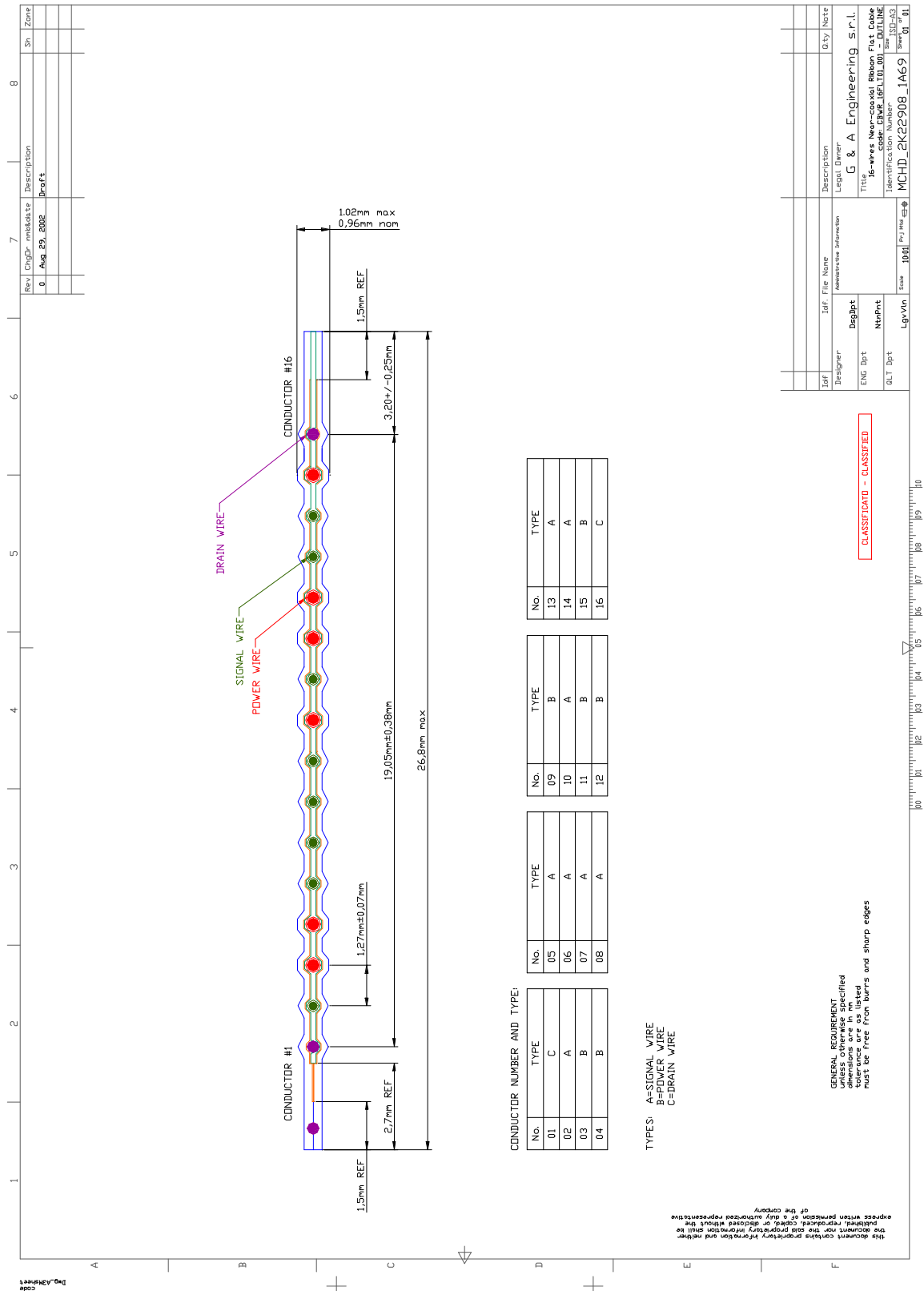


Figura 3



## Figura 4